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IS 10076-1 (1981): linearity control units used with TV Picture Tubes, Part I: General Requirements and Tests [LITD 5: Semiconductor and Other Electronic Components and Devices]



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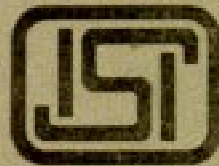


IS : 10076 ( Part I ) - 1981

*Indian Standard*  
SPECIFICATION FOR  
LINEARITY CONTROL UNITS USED WITH  
TV PICTURE TUBES

**PART I GENERAL REQUIREMENTS AND TESTS**

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**INDIAN STANDARDS INSTITUTION**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# *Indian Standard*

## SPECIFICATION FOR LINEARITY CONTROL UNITS USED WITH TV PICTURE TUBES

### PART I GENERAL REQUIREMENTS AND TESTS

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*Indian Standard*  
**SPECIFICATION FOR  
LINEARITY CONTROL UNITS USED WITH  
TV PICTURE TUBES**

**PART I GENERAL REQUIREMENTS AND TESTS**

**0. FOREWORD**

**0.1** This Indian Standard ( Part I ) was adopted by the Indian Standards Institution on 31 December 1981, after the draft finalized by the Transformers and Inductors for Electronic Equipment Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

**0.2** The object of this standard is to establish uniform requirements for the electrical, mechanical and climatic properties and test methods for linearity control unit used with TV picture tubes.

**0.3** Individual specifications for different types of linearity control units which shall cover the requirements appropriate to the type of the linearity control units shall form other parts of the series of standards.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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**1. SCOPE**

**1.1** This standard ( Part I ) deals with the general requirements and methods of tests for judging the mechanical, electrical and environmental properties of linearity control units primarily intended for use with TV picture tubes.

**2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definitions shall apply.

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\*Rules for rounding off numerical values ( *revised* ).

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**2.1 Routine Tests** — Tests carried out on each linearity control units to check the requirements which are likely to vary during production.

**2.2 Acceptance Tests** — Tests carried out on linearity control units selected from a lot for the purpose of acceptance of the lot.

**2.2.1 Lot** — All linearity control units of the same type, category and rating manufactured by the same factory during the same period using the same process and materials.

**2.3 Type Tests** — Tests carried out to prove the conformity to the requirements of this standard. These are intended to prove the general qualities and design of a particular type of linearity control units.

**2.4 Type** — A type comprises products having similar functions manufactured by the same techniques and falling within the manufacturers usual range of ratings for these products.

**2.5 Linearity Control Units** — Linearity control units is a coil wound on a ferroxcube rod and three ferroxdure magnets. It is intended to adjust the linearity of the line deflection.

### 3. TYPE DESIGNATION

**3.1** The type designation used shall be abbreviations to identify a particular type of linearity control unit as given in the following example.

LCU 1 S

where

LCU denotes linearity control unit;

1 represents TV picture tubes of sizes 470 mm, 510 mm, 590 mm and 610 mm; and

S denotes solid state circuitry.

**3.2** The type designation of a particular linearity control unit shall be specified in the relevant specification.

### 4. CLIMATIC SEVERITY

**4.1** The linearity control units shall be subjected to the following climatic severity.

<i>Climatic Test</i>	<i>Severity</i>
[ see IS : 9000 ( Part I )-1977* ]	
Dry heat	70°C for 16 h
Cold	-10°C
Damp heat ( steady state )	21 days
Damp heat ( cyclic )	2 cycles, upper temperature 55°C
Low air pressure	60 kPa

NOTE — Higher severity may be specified, if so required for specific application in the relevant specification.

\*Basic environmental testing procedures for electronic and electrical items: Part I General.



## **5. MATERIALS, CONSTRUCTION AND WORKMANSHIP**

**5.1 Materials** — The components shall be constructed from materials free from flaws and other defects. As far as practicable, materials used for construction shall be non-flammable, non-explosive and non-corrosive.

**5.2 Terminations** — Linearity control units shall be provided with leads or any other acceptable terminations.

**5.3 Workmanship** — All parts of the linearity control units shall be manufactured in accordance with good engineering practices.

## **6. MARKING**

**6.1** Each linearity control unit shall be marked with the following minimum information:

- a) Type designation and manufacturer's name or trade-mark, and
- b) Manufacturer's code or batch number.

**6.2** In all cases the carton shall carry the following minimum information:

- a) Type designation and manufacturer's name or trade-mark,
- b) Manufacturer's code or batch number, and
- c) Recommended application circuits schematic for which the linearity control unit is designed for satisfactory operation.

**6.3** Data sheet giving the following minimum information shall be supplied:

- a) Schematic diagram;
- b) Ratings namely inductance, dc resistance, ac voltage drop; and
- c) Other performance ratings.

**6.4** The markings shall be such as not to become illegible while in storage and during service through normal handling.

**6.5** Any additional marking shall be so applied that no confusion may arise.

**6.6** Linearity control units may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## **7. TESTS**

### **7.1 General Conditions for Tests**

**7.1.1 General** — Tests shall be carried out on the linearity control units received from the manufacturers or suppliers.

**7.1.2 Atmospheric Conditions for Testing** — Unless specified otherwise, all tests shall be carried out under standard atmospheric conditions specified in IS : 9000 ( Part I )-1977\*.

**7.1.3 Preconditioning** — Before measurements are made the linearity controls units shall be stored at the measuring temperature and relative humidity for a time sufficient to allow the entire component to reach these conditions. The recovery period called for after conditioning is adequate for this purpose.

**7.1.4 Correction to be Applied** — When measurements are made at an ambient temperature other than the reference temperature, the results shall, where necessary be corrected to the reference temperature. The ambient temperature during the test shall be stated in the test report.

**7.1.5 Other Precautions** — During measurements the linearity control units shall not be exposed to draughts, direct sun rays or other influences likely to cause errors.

**7.1.6 Test Frequency** — When a test frequency is specified with no tolerance, the frequency used shall be within 1 percent of the specified value.

**7.1.7 Test Voltage** — The test voltages shall be sufficiently free of distortion and noise to such a degree as not to produce any false or spurious indications.

### **7.2 Classifications of Tests**

**7.2.1 Type Tests** — The procedure for type approval shall be in accordance with IS : 2612-1965†.

\*Basic environmental testing procedures for electronic and electrical items: Part I General.

†Recommendation for type approval and sampling procedures for electronic components.

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- a) *Number of samples* — The number of samples for type tests shall be 15 of same code number unless otherwise stated in the relevant specification.
- b) *Sequence of type tests* — The sequence of type tests shall be in accordance with Table 1 unless specified otherwise in the relevant specification.

**TABLE 1 TYPE TESTS**

GROUP	NUMBER OF SPECIMEN	TEST	CLAUSE NUMBER
(1)	(2)	(3)	(4)
0.	All	Visual examination	7.3.1
		Dimensions	7.3.2
		Continuity of winding	7.4.1
		DC resistance	7.4.2
		Inductance	7.4.3
		Correction voltage range	7.4.4
		Voltage proof	7.4.5
		Insulation resistance	7.4.6
1.	3	Solderability	7.5
		Robustness of terminations	7.6
		Bump	7.8
		Vibration	7.7
		Climatic	7.9
2.	3	Damp heat ( steady state )	7.10
3.	3	Endurance	7.11
4.	2	Mould growth	7.12
5.	2	Rapid change of temperature ( when specified )	7.13
6.	2	Salt mist	7.14

**7.2.2 Routine Tests** — The routine tests shall be performed in the following order:

<i>Title of Test</i>	<i>Clause Number</i>
Visual examination	7.3.1
DC resistance	7.4.2
Inductance	7.4.3
Correction voltage range	7.4.4
Voltage proof	7.4.5
Insulation resistance	7.4.6

**7.2.2.1** If during routine tests more than 10 percent of the lot fails, the entire lot may be rejected.

**7.2.3 Acceptance Tests** — The acceptance tests shall be carried out in a limited number of samples selected in accordance with the sampling procedure given in IS : 2612-1965\* and which have passed the routine tests as specified in **7.2.2**.

The two groups of samples shall be selected and each group shall be subjected to the tests specified in the order in Table 2 unless otherwise specified in the individual relevant specification.

TABLE 2 ACCEPTANCE TEST

TITLE OF TEST	CLAUSE NUMBER	AQL* ( Percent Defective )	INSPECTION LEVEL	D/N†
(1)	(2)	(3)	(4)	(5)
<i>Group 'A' Test</i>				
Dimensions	7.3.2			
Continuity of winding	7.4.1			
DC resistance	7.4.2			
Inductance	7.4.3			
Correction voltage range	7.4.4			
Voltage proof	7.4.5	1 percent	IV	N
Insulation resistance	7.4.6			
<i>Group 'B' Test</i>				
Robustness of termination	7.6			
Bump	7.8			
Vibration	7.7	4 percent	I	D
Climatic	7.9			
Visual examination	7.3.1			

\*IS : 2500 ( Part I )-1973 Inspection by attributes and by count of defects (*first revision*).

†D=Destructive and N=Non-Destructive.

### 7.3 General Tests

**7.3.1 Visual Examination** — The linearity control units shall be visually examined for workmanship, finish, condition and marking and these shall be satisfactory.

**7.3.2 Dimensions** — The dimensions shall be checked for compliance with those specified in the relevant specification and as per manufacturers drawings wherein the requirements are not covered.

\*Recommendation for type approval and sampling procedures for electronic components.

## 7.4 Electrical Tests

**7.4.1 Continuity of Winding** — The winding of the linearity control units shall be tested for electrical continuity by any suitable method. The winding shall be continuous.

**7.4.2 DC Resistance** — The dc resistance shall be measured with a resistance bridge or other suitable test equipment. The current through the specimen shall be as small as practical considering the sensitivity of the indicating instruments, unless the current or voltages is specified. When it is important that the temperature of the specimen shall not rise appreciably during measurement, the test voltage shall be applied uninterruptedly for as short a time as practicable, but in no case for more than five seconds, unless otherwise specified. The measurement shall be made at or corrected to 27°C. The value shall be within the tolerance limits as specified.

**7.4.3 Inductance** — The winding, whose inductance is to be measured is connected as shown in Fig. 1 with an external capacitor of value  $C_1$  across it. The resonance frequency  $f_1$  of the circuit is measured by varying the frequency of the RF signal generator for maximum deflection on the electronic voltmeter. The value of the external capacitor is changed to  $C_2$  and the new resonance frequency  $f_2$  is determined. The inductance  $L$  of the winding is then given by:

$$L = \frac{f_2^2 - f_1^2}{4\pi^2 f_1^2 f_2^2 (C_1 - C_2)}$$

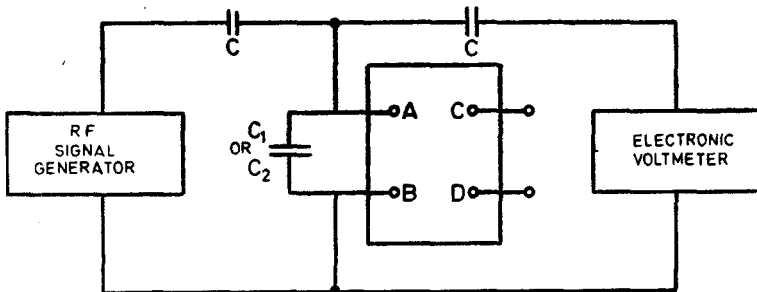


FIG. 1 SET-UP FOR THE MEASUREMENT OF INDUCTANCE

**7.4.3.1** Alternatively, inductance may be measured by a suitable inductance bridge of sufficient accuracy. The values shall be within the limits specified in the relevant detail specification.

**7.4.4 Correction Voltage Range** — A jig based on line output circuit specified by the manufacturers shall be used for testing. When a specified saw tooth current ( without S-correction ), frequency of which and the flyback ratio as specified in the relevant specification flows through the linearity control unit, the correction voltage shall be adjustable between the specified limits.

**7.4.5 Voltage-Proof** — Unless otherwise specified, the linearity control unit shall withstand without breakdown the application of an ac test voltage of the value shown as under:

<i>Maximum Working Voltage</i>	<i>Test Voltage</i>
<i>V</i>	<i>V</i>
25 and below	50
Over 25 up to 50	100
Over 50 up to 100	300
Over 100 up to 175	500
Over 175 up to 700	$2.6 \times \text{Maximum working voltage}$
Over 700	$1.4 \times \text{Maximum working voltage}$ + 1 000

Specimens shall be mounted by normal means. The test voltage shall be applied between windings and the case, if any. The voltage shall be raised at a rate not exceeding 500 V per second and shall be maintained at the maximum value for 1 minute. All windings not under test shall be connected to the case.

When this test is carried out as a routine test, the voltage shall be applied for 5 seconds only. The maximum peak voltage between terminals of line and field coils at 50 Hz shall be 2 500 volts.

The limiting current for the test equipment shall not exceed 2 mA.

**7.4.6 Insulation Resistance** — Unless otherwise specified, the insulation resistance shall be measured by applying dc test voltages as mentioned below for one minute  $\pm 5$  seconds between the case and each winding and also between windings, if applicable. The voltage shall not be applied gradually but shall be applied immediately through the internal resistance of the test apparatus. The insulation resistance shall be read after one minute  $\pm 5$  seconds.

<i>Maximum Working Voltage</i>	<i>Test Voltage</i>
<i>V</i>	<i>V</i>
25 and below	50
Over 25 up to 175	100
Above 175	500

The insulation resistance shall not be less than 1 000 M ohms.

**7.5 Solderability** — The linearity control units provided with the tag and lead type terminations shall be subjected to the soldering iron test ( Method 3 ) with a soldering iron of suitable size in accordance with IS : 9000 ( Part XVIII Sec 1 )-1981\*.

At the end of the test, the component shall be visually examined. It shall not show any loosening of connections, melting or seepage of sealing material or any other deterioration. The continuity of the winding shall also be checked.

## **7.6 Robustness of Termination**

**7.6.1 Tensile Test on all Terminations** — All terminations shall be subjected to the test in accordance with IS : 9000 ( Part XIX Sec 1 )-1978\*. The loading weight, the duration of the test and the number of bends shall be as specified in the relevant specification. In the case of the tag terminations, the bending tests shall be carried out in accordance with IS : 9000 ( Part XIX Sec 3 )-1978\*.

**7.6.2** There shall be no sign of fracture, loosening of parts of any mechanical failure. The continuity of all the windings shall be checked.

## **7.7 Vibration**

**7.7.1** The linearity control unit shall be mounted as required in IS : 9000 ( Part VIII )-1981\* taking care that the terminations are not stressed and that equal number of samples are subjected to vibration test in each of the three principal axes. The vibration severity should be 10-55 Hz within a duration of 6 hours.

**7.7.2** After this test, the linearity control unit shall be visually examined and there shall not be any damage or deterioration. The continuity of the winding shall be checked. The dc resistance and inductance shall be measured and should be within specified limit. Voltage proof test shall be carried out. There shall be no change in insulation resistance when measured at the end of this test.

## **7.8 Bump**

**7.8.1** The linearity control unit shall be mounted as specified in IS : 9000 ( Part VII Sec 2 )-1979\*. Samples shall be subjected to 1 000 bumps at an acceleration of 250 m/s<sup>2</sup>. After the test, the linearity control unit shall be visually examined and shall not show any damage or deterioration.

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\*Basic environmental testing procedures for electronic and electrical items:

Part VII Impact test, Section 2 Bump.

Part VIII Vibration.

Part XVIII Solderability test, Section 1 Solderability of wire and tag terminations.

Part XIX Test for robustness of terminations and integral mounting devices:

Section 1 Tensile test.

Section 3 Bending test.

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**7.8.2** The continuity of the winding shall be checked.

### **7.9 Climatic Tests**

#### **7.9.1 Climatic Sequence**

**7.9.1.1 Dry heat** — The components shall be subjected to this test in accordance with IS : 9000 ( Part III Sec 5 )-1977\*, the temperature of the test chamber being maintained at the appropriate maximum value for the category.

At the end of the period of conditioning and while still at the high temperature, the insulation resistance shall be measured in accordance with **7.4.6** and shall be not less than the following values:

10 or 50 Megaohms as specified in the relevant specification.

The components shall then be removed from the dry heat chamber and allowed to remain under standard recovery conditions.

After recovery, the components shall be visually examined. There shall be no damage or deterioration.

The insulation resistance shall be measured after recovery in accordance with **7.4.6** and shall be not less than the values specified in **7.4.6**.

**7.9.1.2 Damp heat ( cyclic ) ( first cycle )** — The components shall be subjected to the first cycle of this test in accordance with IS : 9000 ( Part V Sec 2 )-1981\*. After the specified period of conditioning, the components shall be removed from the chamber and allowed to remain under standard recovery conditions for a period of one and a half hours.

After recovery, the components shall be visually examined. There shall be no visible damage or mechanical deterioration. The marking shall be legible.

**7.9.1.3 Cold** — The components shall be subjected to this test in accordance with IS : 9000 ( Part II Sec 4 )-1977\*, the temperature of the chamber being maintained at the appropriate value for the category of components under test. The duration of exposure shall be two hours. After the specified period of conditioning, the components shall be removed from the chamber and allowed to remain under standard recovery conditions for a period of two hours.

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\*Basic environmental testing procedures for electronic and electrical items:

Part II Cold test, Section 4 Cold test for heat dissipating items with gradual change of temperature.

Part III Dry heat test, Section 5 Dry heat test for heat dissipating items with gradual change of temperature.

Part V Damp heat ( cyclic ) tests, Section 2 12+12 h cycle.



After recovery, the components shall be visually examined. There shall be no visible damage or mechanical deterioration. The insulation resistance shall not be less than the values specified in **7.4.6**. The magnification factor shall be measured and this shall conform to the specified value.

**7.9.1.4 Low air pressure** — The components shall be subjected to this test in accordance with IS : 9000 ( Part XIII )-1981\*, the test chamber being maintained at a pressure appropriate to the category of the components. The duration of the exposure shall be five minutes.

During the period of exposure, a test voltage equal to 120 percent of the working voltage shall be applied across the winding.

The high voltage test shall be carried out in accordance with **7.4.5**. During and after this test, there shall be no sign of glow, discharge, breakdown, or flashover.

**7.9.1.5 Damp heat ( cyclic ) ( remaining cycle )** — The components shall be subjected to the remaining cycle, of this test in accordance with IS : 9000 ( Part V Sec 2 )-1981\*.

After the specified period of conditioning, the components shall be removed from the chamber and allowed to recover under recovery conditions appropriate to this test.

After recovery, the components, shall be visually examined. There shall be no visible damage or mechanical deterioration. The marking shall be legible. The voltage proof ( high voltage ) and insulation resistance tests shall be carried out in accordance with **7.4.5** and **7.4.6**.

The insulation resistance shall not be less than the values as specified in the relevant specification.

After further period of recovery for 24 hours, the insulation resistance shall be measured in accordance with **7.4.6** and shall not be less than the values as specified in the relevant specification.

The magnification factor shall be measured and shall conform to the specified value.

**7.10 Damp Heat ( Steady State )** — The components shall be subjected to this test in accordance with IS : 9000 ( Part IV )-1979\*. The duration of the exposure shall be appropriate to the category of the components. During exposure, the normal polarizing voltage, to which the components will be subjected in the actual usage, shall be applied. After the specified period of conditioning, the components shall be removed from the chamber and allowed to recover under recovery conditions appropriate to this test.

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\*Basic environmental testing procedures for electronic and electrical items:

Part IV Damp heat ( Steady State ).

Part V Damp heat ( cyclic ) test, Section 2 12+12 h cycle.

Part XIII low air pressure test.

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After recovery, the components shall be visually examined. There shall be no visible damage or mechanical deterioration. Marking shall be legible. The insulation resistance shall be measured in accordance with 7.4.6 which shall not be less than the values as specified in the relevant specification.

After further period of recovery for 24 hours, the insulation resistance shall be measured in accordance with 7.4.6 and it shall not be less than the values as specified in the relevant specification.

The magnification factor shall be measured after the test and this shall conform to the specified value.

**7.11 Endurance** — The component shall be operated at the maximum category temperature for the rated voltage and frequency for 2 000 hours. The loads shall be those for which the component is designed. After completion of the specified duration of operation, the coil shall be exposed to recovery conditions for 24 hours and shall be subjected to the following tests:

- a) *Visual Examination* — There shall be no deterioration so as to impair operations and the markings shall be legible.
- b) *Insulation Resistance* — The values shall not be less than those specified in 7.4.6.

**7.12 Mould Growth** — The components shall be subjected to this test in accordance with IS : 9000 ( Part X )-1979\*.

After expiry of the specified period of exposure, there shall be no mould growth on the components visible to the naked eye.

**7.13 Rapid Change of Temperature ( When Specified )** — This test shall be carried out in accordance with IS : 9000 ( Part XIV Sec 1 )-1978\*. The maximum and minimum temperatures shall be appropriate to the category of the components. The total number of cycles shall be five. The period of exposure to both maximum and minimum temperature shall be one hour each.

After exposure, the components shall be removed from the chamber and allowed to recover under conditions appropriate to this test. The components shall be visually examined and there shall be no visible damage or mechanical deterioration.

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\*Basic environmental testing procedures for electronic and electrical items:

Part X Mould growth test.

Part XIV Rapid change of temperature, Section 1 Rapid change of temperature by two-chamber method.

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After recovery, the components shall be subjected to high voltage test and insulation resistance test in accordance with 7.4.5 and 7.4.6 respectively. The insulation resistance shall be not less than the values specified in 7.4.6.

**7.14 Salt Mist** — The components shall be subjected to salt mist test in accordance with 7.10 of IS : 589-1961\* the period of exposure shall be four days.

After specified period of conditioning, the components shall be removed from the chamber and allowed to recover under recovery conditions appropriate to this test.

After recovery and cleaning, the components shall be visually examined. There shall be no corrosion or mechanical deterioration or any other visible damage. The marking shall be legible. The continuity of winding, and the robustness of terminations shall be checked.

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\*Basic climatic and mechanical durability tests for components for electronic and electrical equipment ( *revised* ).